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Title: Pressure Ulcer Assessment Via Telemedicine

OBJECTIVES: The primary objective of this pilot study is to evaluate the clinical accuracy of a telemedicine system for assessing the status of pressure ulcers, both chronic and those which have been surgically repaired. The telemedicine system consists of three major data collection components: (1) digital photograph of ulcer; (2) quantitative measurements of wound status (i.e., ulcer area and volume, skin elasticity); and (3) other wound and patient data collected by a nurse. The data are collected via a laptop computer and then transmitted to a central database, where a computer program transforms the data into the necessary reporting format. The output is posted onto a World Wide Web page for access by the consulting physician. The system incorporates all of the data requirements for assessment recommended by the Agency for Health Care Policy and Research's (AHCPR) Clinical Practice Guideline, "Treatment of Pressure Ulcers." The principal hypotheses to be addressed are: (1) use of the telemedicine system results in the same diagnoses as does the process of assessing the patient in person; and (2) patients are satisfied with the telemedicine system. Secondary objectives include: (a) evaluating the validity of two clinical variables included in the AHCPR guidelines-- nutrition status and pain; (b) development and evaluation of a questionnaire for measuring patient satisfaction with telemedicine; and (c) refining the procedures for taking photographs and quantitative measurements of pressure ulcers.

RESEARCH PLAN: The one and a half year study will consist of a prospective cohort design, which compares the diagnostic evaluation resulting from a physician's review of the telemedicine data with a physician's in-person assessment (the "gold standard"). Two VA medical centers and two specialties are participating in the study: Ann Arbor (plastic surgery) and Augusta (plastic surgery, physical medicine and rehabilitation). All study patients (inpatients and outpatients with a pressure ulcer of stage II, III, or IV) are assessed both in-person and with the telemedicine system. The in-person and telemedicine physicians provide yes/no responses to four diagnostic questions concerning wound healing and infection, based on AHCPR guidelines, and they are blinded to each other's assessments. Patient satisfaction data will be collected using a specially designed, self-administered questionnaire and will measure perceptions regarding the burden of the telemedicine system, confidence in the evaluation, and absence of direct contact with a physician. Pain and nutrition status will be measured using existing instruments with established validity and reliability.

METHODS: Accuracy of the telemedicine system compared to the in-person assessments will be measured using sensitivity, specificity, and area under the ROC (receiver operating characteristic) curve. Patient satisfaction will be measured using a single sample *t*-test, comparing observed responses with a "satisfied" response on a 5-point Likert scale. Validity of pain and nutrition status will be measured by calculating the product moment correlation coefficient between these outcomes and quantitative indicators of pressure ulcer status, such as stage, area, volume, and skin elasticity.

FINDINGS: The study began October 1, 1998, with patient enrollment beginning in February 1999 at the Augusta VAMC, and in June 1999 at the Ann Arbor VAMC. As of the end of March 2000, 74 patients have been enrolled, with data collected on 324 visits. Results of an analysis performed in December 1999 showed the rates of agreement between the participating physical medicine and rehabilitation physicians on assessment of chronic pressure ulcers were 55.3% for identification of necrosis, 89.4% for cellulitis, and 58.1% for osteomyelitis (N = 94 visits). Rates of agreement of between the participating plastic surgeons (Ann Arbor) on assessment of chronic pressure ulcers were 70.8% for necrosis, 83.3% for cellulitis, and 68.2% for osteomyelitis (N = 24 visits). Rates of agreement between the participating plastic surgeons (Augusta) on assessment of pressure ulcers that had been surgically repaired were 93.6% for necrosis and 88.5% for cellulitis (N = 78 visits). When compared with "baseline" % agreement (i.e., agreement between the same physicians when both assessed a different sample of patients in person), these rates of agreement are significantly lower for the PM&R physicians when identifying necrosis and osteomyelitis. Agreements for the plastic surgeons are not significantly different from baseline. The project is ongoing and is expected to be completed September 2000. By April 15, 2000, we will have a demonstration Web site established, which will replicate the Web site used by the telemedicine physicians. The site will contain a sample of patient data (no identifiers are present and all participating patients have consented to allow their data to be shown) and can be accessed using the following address: <http://www2.med.umich.edu/wats/login.cfm>. User ID: Demo. Password: DMWound.